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PATENT SPECIFICATION (21) 58,612/73

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Complete Specification entitled	(54)	ECCENTRIC LOCKING DEVICE FOR SURGICAL DRAINAGE MEMBERS
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Actual Inventor	(72)	THEODORE FLORIAN FELCZAK
Related Art	(56)	272136 (29209/63) 87.2, 87.4, 22.4.

The following statement is a full description of this invention, including the best method of performing it known to us :

11744/75—1. X770-71-ZD-13P.C. F. D. Atkinson, Government Printer, Canberra

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This invention relates to an improved device especially adapted for removing fluid from a body cavity by surgical puncture or drainage. More specifically, it relates to an improved locking guard device, mounted on the shaft of a hollow member such as a needle or semi-rigid catheter, intended to regulate the depth of penetration of the needle or catheter into a body cavity in a paracentesis or catheterization procedure, especially thoracentesis.

In a thoracentesis procedure, a sharp-pointed hypodermic needle, or the like is thrust into the pleural cavity in order to remove fluid. Various well-known valve arrangements are employed to allow the aspiration of fluid without allowing air to enter the pleural cavity, with the consequent danger of lung collapse.

In inserting the aspirating needle into the cavity, it is most important that the depth of penetration be closely controlled, so that the pleural cavity will be tapped but without the danger of excessive penetration which could cause the sharp needle point to puncture or tear the lung itself. The desired degree of penetration may vary with the physical condition of the patient.

Various expendients have been resorted to in the past to serve as a guard or stop mechanism, controlling the depth of penetration of the needle. One well-known method is to clamp a hemostat on the needle shaft.

Others include the clamping of a coiled spring on the shaft, as in U.S. Patent 3,477,437, and various set-screw arrangements as in U.S. Patents 2,001,638 and 2,338,800.

It is with improvements in the art of providing such depth guards that the present invention is concerned, and it is a primary object of the invention to provide a disposable light-weight guard which can be readily adjusted to any desired position on the shaft of a cannula, but which can be locked tightly onto said shaft by a simple manipulation.

It is an additional object of the invention to provide such a guard which can be slidably adjusted to any desired position on the shaft and locked onto the shaft by a rotation of one element of said guard.

According to one aspect of the present invention there is provided a surgical instrument comprising a cannula and a guard which is mounted on the cannula, is movable along the length of the cannula, and is adapted to be locked to the cannula, the guard serving to control the depth of penetration of the cannula and consisting of male and female elements, the male elements having a cylindrical spigot and the female element having a cylindrical cavity for receiving the spigot, both elements having through-going cylindrical channels accommodating the cannula and eccentric to the axes of the spigot and the cavity respectively, and rotation of either element with respect to the other, from a position in which the channels are aligned, being effective to cause frictional engagement between the outer surface of the spigot and the inner surface of the cavity and simultaneous locking of the guard to the cannula.

The invention will be better understood from the following description and drawings, in which:
FIGURE 1 is a perspective view of one embodiment of this invention, mounted on a needle shaft.
FIGURE 2 is a cross-sectional representation of the elements of FIGURE 1, in dismantled relationship.
FIGURE 3 is an end view of the coupled elements of the embodiment shown in FIGURE 1, each containing a circular passageway concentric with each other, but with both

passageways eccentrically disposed with respect to the true centers of the elements.

FIGURE 4 is a view of the embodiment as in FIGURE 3 showing the constricting effect on the passageway caused by rotation of one of the elements.

FIGURE 5 is a cross-sectional view of the elements of another embodiment of the invention having means to hold the elements thereof together and means to hold the device in position on the body.

FIGURE 6 is a perspective view of another embodiment of the invention in use, locked on a cannula, and held in position on a patient.

For convenience, similar or equivalent elements of the device shown in the drawings, are identified by the same numerals.

Referring to FIGURE 1, a male element 10 and a female counterpart 20 are shown positioned on the shaft of a hollow needle 30. In the cross-sectional view as shown in FIGURE 2, the element 10 may consist of a cylindrically-shaped shoulder portion 12 and a projecting cylindrical portion 14, which fits into the cylindrically shaped cavity 26 in the female element 20, the outer surface 31 of the projection 14 being frictionally engageable with the inner surface 32 of the cavity 26 upon rotation of the elements 10

and 20 with respect to each other, as will be described below. The element 20 is conveniently moulded or machined in the form of two disk-like portions 22 and 24, connected by a stem portion 25. The end disk portion 22 serves as the flange-like guard which in use presses against the body and determines the depth to which the needle can penetrate into a body cavity.

The male element 10 and female element 20 are each provided with channels drilled or otherwise formed throughout their lengths (16 and 28, respectively). As shown, these channels are concentric in at least one rotational position of the elements with respect to each other so that, when elements 10 and 20 are coupled with the holes 16 and 28 in alignment with each other they provide a passageway through which the needle 30 can slide readily through the assembly. The elements as located, however, at unequal distances from edge portions of their respective elements, such as the unequal distances 15 and 17 and 27 and 29 in elements 14 and 26, respectively. In the embodiment shown, they are located eccentrically with respect to the true centers of the cylindrical projecting male portion 14 and cavity 26, the degree of eccentricity being determined by the ratio of the distance 15 to 17 and 27 to 29.

With the elements 10 and 20 coupled together and in position on the needle shaft as in FIGURE 1, simple rotation of one of the pair of elements will cause a

constriction in the passageway, formerly concentric, formed by the channels 16 and 28. This is shown in principle in FIGURES 3 and 4 which are views of the coupled elements 10 and 20 from the disk end 22. Rotation of one of the elements 10 or 20 with concentric channels eccentrically disposed with respect to their true centers (FIGURE 3) results in a constriction of the formerly circular passageway (FIGURE 4) at the interface between the end of the male projection 14 and the bottom of the cavity 26.

When the shaft of the needle 30 is inserted through the passageway with the female and male elements 10 and 20 in coupled relationship as shown in FIGURE 1, the displacement of one channel portion of the passageway is resisted by the shaft and tends to cause the elements 10 and 20 to rotate about the shaft, which of course is eccentrically located with respect to the true centers of these elements, specifically the centers of the male projecting portion 14 and female cavity portion 26. This brings the outer surface 31 of the male projection 14 into frictional engagement with the inner surface 32 of the female portion 26 and surfaces of the channels 16 and 28 into frictional engagement with the shaft, with a consequent locking action of the guard on the shaft.

In the use of this device in a surgical procedure, the desired penetration depth may be first determined. The guard elements may be assembled in coupling relationship

with the male projecting portion 14 positioned in the female cavity portion 26. The elements are rotated so that the channels 16 and 28 are in alignment to provide an unobstructed passageway therethrough. The needle is inserted through the passageway with the tip extending past the end disk 22 for a length equal to the predetermined penetration depth. The elements 10 and 20 are rotated with respect to each other and, with slight tightening force, the guard is locked at the chosen location on the needle shaft. The doctor or medical assistant may now grasp the guard for better control of the needle during the puncturing and penetration procedure. Penetration of the needle beyond the predetermined depth is prevented by the flange-like surface of the end disk 22 coming into contact with the body surface. If desired in some instances, the guard may be temporarily positioned on the shaft remote from the tip, either in a locked or unlocked position, and then moved and locked into position with the end disk 22 against the patient's body to prevent accidental movement of the shaft into a position of deeper penetration in the body. It will be appreciated that this invention provides devices which are lockable and unlockable by a displacement motion which is generally transverse to the axis of the shaft.

The guard may be provided with means for stable securement thereof and maintenance of the needle in place against dislodgement from the body cavity. As shown in

FIGURE 5, the surface of the end disk 22 is provided with a coating of pressure-sensitive adhesive 33 which is pressed into adhering contact with the skin of the patient. The surface of the adhesive may be provided with a releasable facing sheet for protection of the adhesive layer prior to use, as in the case of facings conventionally used in adhesive finger bandages. Other means for retaining the guard may be provided; for example, body straps 34 may be attached to the end disk 22 as shown in FIGURE 6.

FIGURE 5 also illustrates a variation of the embodiment of FIGURE 1 by which the elements 10 and 20 are coupled together against axial displacement and separation of one from the other. The elements 10 and 20 are held together by a ring and groove means on the interfitting male projecting portion 14 and female cavity 26. As specifically shown in the drawings, a ring-like ridge 41 is integrally formed on the male projecting portion 14 for fitment into a ring-like groove 40 in the sidewall of the cavity 26. The outer diameter of the ridge 41 is slightly larger than the inner diameter of the cavity 26 but no greater than the diameter of the groove 40.

The terms "disk" or "disk-shaped" herein are not confined to true disk shapes. It will be obvious that the male and female locking elements may be in the form of cylinders, squares or other polygons, or the like, provided that concentricity-eccentricity of the channels

therethrough is maintained. For convenience in rotation, the outside surfaces of one or both elements may be knurled or provided with bosses or the like.

For economy, lightweight, and sterilizability it is preferred that the product of this invention be moulded from a slightly resilient or deformable plastic material such as DELRIN (a du Pont trademark for an acetal resin), polystyrene, polystyrene-acrylonitrile, or the like. The slight deformability of most plastic materials allows a frictional engagement or compressive fit so that the surface 31 frictionally engages with the surface 32 when the male and female elements are brought together, so that the two elements are held together. An alternative form of engagement is a tongue and groove arrangement of the male element against the female element.

In actual size, the disk-shaped element serving as the actual guard shield may be one inch or less in diameter, and the total height of the interlocked elements may be 0.75 inches or less, with other dimensions in proportion. In many routine thoracentesis procedures, a size 16 needle is used, 0.063 inches in outside diameter. Using a pair of moulded plastic elements, it has been found that the channels 16 and 28 need be no larger in diameter, and may even be as small as 0.060 inches in diameter and still provide an adjustable sliding fit on the No. 16 needle shaft, due to the

above-mentioned deformability of plastic materials.

Although the foregoing description relates to the use of the locking device of this invention in a thoracentesis procedure, it will be obvious to those skilled in the art that it is equally useful in limiting the depth of penetration of other rigid or semi-rigid surgical drainage appliances, such as plastic suprapubic catheters.

The claims defining the invention are as follows:

1. A surgical instrument comprising a cannula and a guard which is mounted on the cannula, is movable along the length of the cannula, and is adapted to be locked to the cannula, the guard serving to control the depth of penetration of the cannula and consisting of male and female elements, the male element having a cylindrical spigot and the female element having a cylindrical cavity for receiving the spigot, both elements having through-going cylindrical channels accommodating the cannula and eccentric to the axes of the spigot and the cavity respectively, and rotation of either element with respect to the other, from a position in which the channels are aligned, being effective to cause frictional engagement between the outer surface of the spigot and the inner surface of the cavity and simultaneous locking of the guard to the cannula.

2. An instrument according to claim 1, wherein the spigot has a ridge adapted to engage a groove in the cavity to prevent axial separation of the elements of the guard.

3. An instrument according to claim 1 or claim 2, wherein the female element of the guard has a flange facing the end of the cannula which is to be inserted in a patient's body.

4. An instrument according to claim 3, wherein the flange is coated with a pressure-sensitive adhesive.

5. An instrument according to claim 3, wherein said flange has a strap attached to it.

6. An instrument as claimed in claim 1, substantially as described herein with reference to Figs. 1-4 of the accompanying drawings.

7. An instrument as claimed in claim 1, substantially

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as described herein with refsrence to Fig. 5 of the accompanying drawings.

Dated: 9th December, 1975

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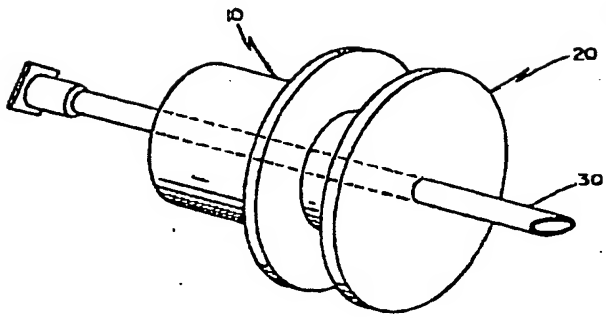

FIG 1

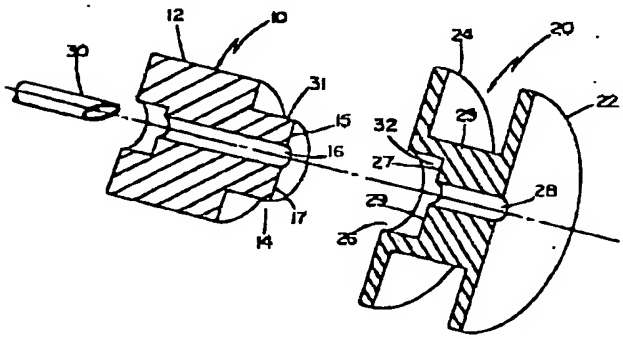

FIG 2

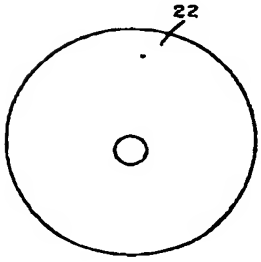

FIG 3

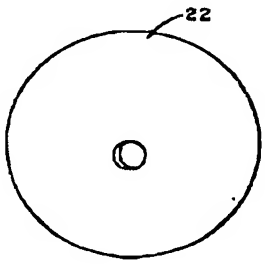

FIG 4

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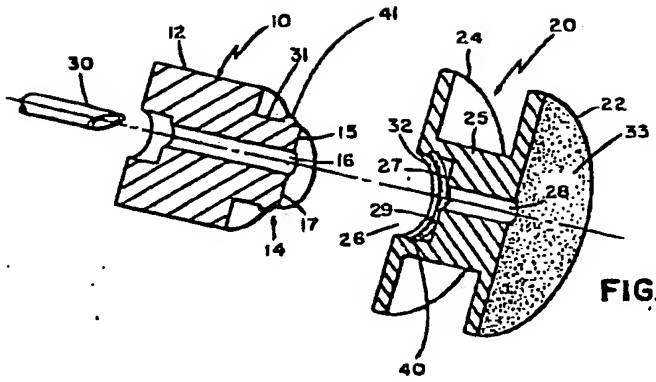

FIG. 5

FIG. 6